REMARKS

In response to the outstanding Office Action, the claims of this application have been further amended in order to clarify the differences between this invention and the prior art, without giving up all equivalents between the new and previous claim language.

In paragraph 3 of the Office Action, the Examiner has rejected claims 1,2,5 and 6 as obvious in view of Andrews and Morgan. This rejection is hereby traversed, and it is submitted that claims 1, 2,5 and 6 are fully distinguished from these references, along with new claim 11 which depends from claim 1. (Claim 3 is not rejected based on these references alone, and will therefore be discussed below in connection with the rejection in paragraph 4, along with new claims 7 to 10 which depend from claim 3). In the foregoing amendment, claim 1 has been amended only to render explicit certain elements which were previously implicit in this claim - i.e. the electromagnets being arranged in diametrically opposed pairs, which was previously implicit from claim 1, lines 11 to 13, and the fact that only one pair of diametrically opposed electromagnets is activated by the switching assembly at any one time, which was also previously implicit in the last three lines of claim 1.

The Examiner contends that Andrews has all the features of claim 1, apart from the single, elongate, linear rotor member projecting radially outwardly in two opposite directions and having only two opposite ends located adjacent only two diametrically opposed electromagnets at any time as the rotor rotates, and the switching assembly activating opposed pairs of electromagnets in sequence around the ring. The Examiner also contends that Andrews "indicates that a two pole rotor could also be used in column 2, lines 55-60". This contention is hereby traversed. Andrews makes absolutely no mention of a two pole rotor. The passage referred to by the Examiner

states only that "any number of pairs of poles may be provided on the rotor 12". This passage goes on to state that "the stator assembly 14 is provided with a plurality of pole units 34 corresponding in number to the rotor poles 30." (column 2, lines 61 to 63). Andrews' arrangement is such that the pole pieces 34 alternate in polarity around the rotor 12, such that, at any given time, adjacent pole pieces 34 in the ring will be of opposite polarity (column 3, lines 2 to 5). Thus, even if Andrews were modified such that the rotor had a different number of poles, the number of pole pieces 34 would have to be increased or decreased accordingly for Andrews invention to work according to his teachings. Andrews clearly neither describes nor suggests use of a two-pole rotor while maintaining a plurality of electromagnets and pole pieces, since the number of rotor poles in his invention must be equal to the number of stator pole pieces. It clearly would not be obvious to modify Andrews to provide a two pole rotor and two pole pieces 34, since the invention would no longer work, and it is therefore submitted that the Examiner is incorrect in stating that the indication in Andrews that the number of poles could be changed would include a change to only two poles. It would be immediately clear to one skilled in the field that this could not work.

The Examiner goes on to argue that it would be obvious to replace the six pole rotor of Andrews with the two pole rotor of Morgan "since Andrews and Morgan are all from the same field of endeavor". This argument is hereby traversed. Not only are Andrews and Morgan from different and non-analogous fields of endeavor, but the proposed modification of Andrews would not be obvious with or without the teachings of Morgan and would, in fact, be completely contrary to the teachings of Andrews.

Considering first whether Andrews and Morgan are from the same field of endeavor, it is noted that Andrews describes a permanent magnet motor, whereas Morgan is concerned with an electrically actuated indicator for indicating one of a plurality of numbers or symbols, such as the numbers 0 to 9. One objective of Morgan

is to provide an indicator requiring fewer lines and electromagnets than was necessary prior to the invention, and another objective is to provide permanent magnetic holding means for retaining the indicator in a discrete position. A numeric indicator is clearly in a completely different and non-analogous field of art to a permanent magnet motor, and it is submitted that the proposed combination of references is unobvious for this reason.

Additionally, even if the references were in the same or analogous fields for the purpose of considering obviousness, the combination proposed by the Examiner would still not be obvious. As has been noted above, one of the main features of Andrews is a rotor having a number of pairs of poles 30 and a stator assembly arranged in a ring around the rotor and having pole units 34 **equal in number** to the rotor poles 30 (column 2, lines 60 to 65). This ensures that each rotor pole is always close to the next pole unit, providing a motor which is positively self-starting and capable of developing a substantial starting torque. Each pole piece or unit in Andrews is adapted to be magnetized by an electromagnet unit comprising two coils, one of which gives the pole unit a north polarity and the other of which gives the pole unit a south polarity, the arrangement being such that the pole units have alternating polarity around the ring, as described in column 4, lines 46 to 57. Figure 10 illustrates one switch arrangement in which a first set of contacts 308a are connected together and arranged to supply power to the coils 40, and a second set of contacts 308b are similarly connected together to supply power to the coils 42. As the rotor rotates, brush 306 contacts each of the contacts 308a and 308b in turn around the ring, such that coils 40 and 42 are alternately energized and the polarity of the pole units is alternately reversed.

In contrast to Andrews, who requires an equal number of rotor and stator poles and has the main objectives of providing a self-starting motor which is capable of

providing high starting torque, Morgan describes a simple electromagnetic indicator in which a drum is rotated to display a series of numerals in a window 11. The objectives in Morgan are achieved because of the small number of electromagnets used, in this case three (column 1, lines 25 to 27). Morgan has a single, linear rotor member having opposite N and S ends, but only **one** end of the rotor is located adjacent the electromagnets at any one time (see Figure 2), since the three electromagnets 15,16 and 17 are arranged in an arc extending around less than 180 degrees. Thus, the Examiner's statement on page 3, last four lines, that the rotor ends in Morgan are located "adjacent only two diametrically opposed electromagnets...." is incorrect, since Morgan does not even have any diametrically opposed electromagnets. Morgan also does not have any switching assembly which activates pairs of diametrically opposed electromagnets in sequence around a ring (Office Action, page 4, lines 1 to 4). Instead, the switching assembly in Morgan, illustrated in Figure 7, is arranged to energize the electromagnet 15 alone, the adjacent electromagnets 15 and 16 simultaneously, the electromagnet 16 alone, the adjacent electromagnets 16 and 17 simultaneously, or the electromagnet 17 alone (see column 2, lines 38 to 56). The Examiner's interpretation of the teachings of Morgan is therefore incorrect, and reads into this reference subject matter which is completely lacking, specifically diametrically opposed electromagnets and a switching assembly for activating diametrically opposed electromagnets in turn. Neither Andrews nor Morgan provides any such teaching.

It is well established that, in order to establish *prima facie* obviousness of a claimed invention, three criteria must be met. First, there must be some suggestion or motivation in the references themselves or knowledge generally available in the art to combine the reference teachings. Secondly, there must be a reasonable expectation of success. Third, all the claim limitations must be taught or suggested by the prior art.

The references must be viewed without hindsight based on the teachings of the invention which is the subject of the claims in question.

If all of these criteria are taken into consideration, it is clear that the Examiner has failed to establish obviousness of claim 1 based on Andrews and Morgan. Clearly, there is no motivation taught by these references for modifying Andrews to provide a two pole rotor, since Andrews clearly teaches that there must be an equal number of rotor and stator poles, and an arrangement with only two stator poles would lack the self-starting ability which is critical to Andrews' invention. There is nothing in the teachings of Morgan which would indicate that there would be any advantage to modifying Andrews to incorporate some or all of Morgan's teachings. Self-starting and high torque are not a requirement for Morgan's rotating drum numeric indicator.

Even if the teachings were combined, it is clear that some of the claimed elements are not taught by either reference, and the third criterion for establishing obviousness is also not met. There is absolutely no suggestion in either Andrews or Morgan of providing electromagnets at spaced intervals around a circle or ring such that they are arranged in diametrically opposed pairs, and then connecting them to a switching assembly such that successive pairs of diametrically opposed electromagnets are activated in turn around the ring, with power being connected to only one pair of diametrically opposed electromagnets at any one time. In Andrews, the electromagnets do lie in diametrically opposed pairs, but Andrews' switching assembly is arranged to activate all of the electromagnets around the ring at any one time, and then to reverse their polarity, rather than activating only one diametrically opposed pair at any one time. Morgan does not have diametrically opposed pairs of electromagnets, but only has three electromagnets arranged in an arc, and has a switching assembly which activates only one electromagnet or two adjacent

electromagnets in the arc at any one time. Thus, neither reference teaches or suggests successive activation of pairs of diametrically opposed electromagnets around the ring.

Since these elements are completely lacking from both Andrews and Morgan, it is clear that claim 1 is not obvious in view of these references, and reconsideration and reversal of the rejection of claim 1 is respectfully requested.

Claims 2,5,6 and 11 depend from claim 1 and are distinguished from Andrews and Morgan for the same reasons as claim 1, and additionally since these claims define other features lacking from the references. Referring to new claim 11, neither reference suggests providing a chamber between the electromagnets and one end wall of the housing, providing space for mounting a power supply and generator.

In paragraph 4 of the Office Action, claims 3 and 4 are rejected as obvious in view of Andrews and Morgan when further combined with Bates. This rejection is hereby traversed, and it is submitted that claim 3 and new claims 7 to 10 which depend from claim 3 are all fully distinguished from these references (claim 4 has been canceled).

In the foregoing amendment, claim 3 has been rewritten as an independent claim to claim explicitly elements which were previously implicit in this claim. As noted above, the proposed combination of Andrews and Morgan is not obvious since no motivation for such a combination is present in the references, and such a combination would still lack a number of the elements claimed in claim 3. Thus, as has been noted above in conjunction with claim 1, neither Andrews or Morgan suggests a switching assembly arranged to activate successive pairs of diametrically opposed electromagnets in turn around a ring of such electromagnets, with only one pair of opposed electromagnets being activated at any one time. Also, neither of these references suggests having opposing pairs of contacts arranged in a ring with each opposing pair of contacts connected in a circuit separate from all other circuits to a

respective single pair of opposing electromagnets, contrary to the Examiner's assertions in the first paragraph on page 5. In Andrews, Figure 10, a commutator arrangement is shown in which **alternating** contacts are connected together in a circuit which is also connected to **all of the electromagnets**. Thus, in Figure 10, all three contacts 308a are connected together, and all three contacts 308b are connected together, with contacts 308a connected to each coil 40 via lead 260 and contacts 308b connected to each coil 42 via lead 264. No diametrically opposed contacts are connected together, and **all** electromagnets are activated at anyone time (albeit with opposite polarity around the ring). This is clearly completely different from the arrangement claimed in claim 3, where a pair of diametrically opposed contacts is connected to only one pair of diametrically opposed electromagnets.

The electromagnet and contact arrangement of claim 3 is also not described or suggested by Morgan. Morgan does not even have contacts arranged in a ring, let alone diametrically opposed contacts connected together in pairs and also connected in a circuit with only two diametrically opposed electromagnets. Instead, the switching assembly is arranged as illustrated in Figure 7, and the switches are actuated manually with push buttons.

These elements of claim 3 which are lacking from the first two references are also lacking from Bates. Bates is concerned with a commutation arrangement having an outer stator carrying a single armature winding and an inner rotor 2 carrying a field winding. Electrical connection to the stator armature winding is provided through a commutation arrangement which has contact members in a fixed ring 21 and contact wheels mounted to rotate with the rotor shaft 4. Contrary to the Examiner's assertion, diametrically opposed contacts 21 are **not** connected to diametrically opposed pairs of electromagnets. There are no diametrically opposed pairs of electromagnets, but only a single, closed armature winding 30 with eight external connections 31 to 38,

as illustrated in Figure 4 and described in column 2, lines 49 to 52. The conducting segments of the commutator are all connected to a single armature winding (column 2, lines 28 to 30). The commutator 39 of Figure 4 has conductive segments 41 to 48, and a single connection 31 of the armature winding 30 is connected to diametrically opposite segments, such as segments 41 and 45, of the commutator, and so on, as indicated in Figure 4 (see column 2, lines 60 to 63). A similar arrangement is provided with the commutator of Figure 5. Thus, Bates also does not describe or suggest any arrangement in which a pair of diametrically opposed contacts is connected to a single pair of diametrically opposed electromagnets, but instead shows diametrically opposed contact segments both connected to a single connection point or junction (such as junction 31) on a single armature winding 30.

It is therefore submitted that the invention as claimed in claim 3 is not obvious in view of the teachings of Andrews, Morgan and Bates, none of which describe or suggest an electromagnet, contact and switching arrangement as claimed in this claim. Reconsideration and reversal of the rejection of this claim is respectfully requested.

Claims 7 to 10 are also distinguished from the references for the same reasons as claim 3 and additionally since these claims define other elements lacking from the references. Referring to claim 7, none of the three references suggests a separate switch housing for the contacts and wiper. Instead, in all three cases, the switch contacts are mounted in the same housing as the electromagnets (or single armature winding in the case of Bates) and within the same region. Referring to claims 8 and 9, the contact and electromagnet position relationship defined in these claims is also completely lacking from the references. Morgan and Bates do not even have a ring of contacts arranged such that diametrically opposed contacts are in corresponding angular positions to diametrically opposed electromagnets, let alone connection of each pair of diametrically opposed contacts to the next pair of diametrically opposed

electromagnets in the ring, as defined in claim 9. Although Andrews does have diametrically opposed contacts, these are not connected together in circuits (instead, alternating contacts around the ring are connected together), nor are they connected to only one pair of diametrically opposed electromagnets, let alone the specific pair as defined in claim 9.

It is therefore submitted that new claims 7 to 10 are also distinguished from the references cited in paragraph 4.

It is believed that this response deals with all outstanding grounds of rejection and that all claims remaining in this application (claims 1 to 3 and 5 to 11) should now be in condition in all respects for allowance. Early notice to this effect is earnestly solicited. If there are any outstanding grounds of objection or rejection which could be dealt with by means of a telephone interview, the Examiner is encouraged to contact the undersigned representative.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Claims 1 and 3 are amended as follows:

1. (Amended) An electromagnetic motor, comprising:

an outer housing having a central axis and opposite end walls;

a shaft rotatably mounted in the housing to extend along the central axis and projecting out through one end wall of the housing;

a plurality of electromagnets extending parallel to the shaft and mounted at spaced intervals [in] around the entire circumference of an annular ring centered on the central axis and spaced radially outwardly from the shaft, each electromagnet being located diametrically opposite to another electromagnet in the ring such that the electromagnets are arranged in diametrically opposed pairs;

a single, elongate, linear rotor member of ferromagnetic material secured to the shaft and projecting radially outwardly from the shaft in two opposite directions to extend up to the annular ring of electromagnets, the rotor having only two opposite ends located adjacent the ring of electromagnets, whereby the rotor ends are located adjacent only two diametrically opposed electromagnets at any time as the rotor rotates;

a power supply; and

a switching assembly for connecting the power supply to successive pairs of diametrically opposed electromagnets in order to activate each pair of diametrically opposed electromagnets in sequence around the ring, such that the opposite ends of the rotor are attracted to successive activated opposed pairs of electromagnets in turn around the ring, and power is supplied to only one pair of diametrically opposed

electromagnets is at any one time, whereby the rotor and shaft are rotated in a predetermined direction.

3. (Amended) [The] An electromagnetic motor [as claimed in claim 1, wherein], comprising:

an outer housing having a central axis and opposite end walls;

a shaft rotatably mounted in the housing to extend along the central axis and projecting out through one end wall of the housing;

a plurality of electromagnets extending parallel to the shaft and mounted at spaced intervals around the entire circumference of an annular ring centered on the central axis and spaced radially outwardly from the shaft, each electromagnet being located diametrically opposite to another electromagnet in the ring, whereby the electro-magnets are arranged in diametrically opposed pairs;

a single, elongate, linear rotor member of ferromagnetic material secured to the shaft and projecting radially outwardly from the shaft in two opposite directions to extend up to the annular ring of electromagnets, the rotor having only two opposite ends located adjacent the ring of electromagnets, whereby the rotor ends are located adjacent only two diametrically opposed electromagnets at any time as the rotor rotates;

a power supply;

a switching assembly for connecting the power supply to successive pairs of diametrically opposed electromagnets in order to activate each pair of diametrically opposed electromagnets in sequence around the ring, the switching assembly connecting power to only one pair of diametrically opposed electromagnets at any one time, such that the opposite ends of the rotor are attracted to successive activated

opposed pairs of electromagnets in turn around the ring, whereby the rotor and shaft are rotated in a predetermined direction; and

the switch assembly compris[es]ing a plurality of electrical contacts equal in number to the number of electromagnets, the contacts being arranged in the housing in an annular ring centered on the central axis, the contacts being positioned in diametrically opposed pairs, and a linear, elongate contact wiper [rotatably mounted at the central axis so as to] secured to the shaft and extending radially in opposite directions from the [axis and] shaft so as to successively contact each pair of diametrically opposed contacts around the ring in sequence as the shaft rotates, each opposing pair of contacts being electrically connected to a respective opposing pair of electromagnets in a respective circuit separate from all other circuits in the switch assembly, and the wiper being connected to the power supply, whereby diametrically opposed pairs of electromagnets are activated in sequence around the ring in order to attract the rotor member to the next successive adjacent opposed pair of electromagnets in turn around the ring.

Claim 4 is canceled.

New claims 7 to 11 are added.